

# ES&H manual

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## Environment, Safety, and Health

### Volume I

#### Part 3: Safety Analysis and Work Plans and Procedures

## 3.2 Safety Basis Thresholds

**Recommended for approval by the ES&H Working Group**

**Approved by:** Robert W. Kuckuck  
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**New document or new requirements**

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## 3.2

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<sup>1</sup> Minor revision

## 3.2

### Safety Basis Thresholds

#### 1.0 Introduction

The "Laboratory's Integrated Safety Management System (ISMS) Description" and subordinate documents, including the LLNL *Environment, Safety and Health, (ES&H) Manual*, emphasize how to do work at the work activity level. For an R&D organization, the focus is on individual work activities because the work being done can change from one day to another. Nevertheless, most work activities take place within a facility and must, therefore, satisfy the requirements imposed by that facility's constraints. This document:

- Summarizes LLNL's facility authorization level (FAL) ES&H processes.
- Shows how those FAL processes couple to LLNL's work activity level (WAL) processes.
- Provides references to the applicable sections of the LLNL *ES&H Manual*<sup>2</sup>.

In addition, this document provides facility managers (FM), facility points of contact (FPOC), and other concerned personnel with guidelines and access to tables to help in verifying that new or revised work activities do not introduce materials outside the bounds of the Safety Basis Envelope (SBE, see Section 2.0) established for a given facility. The quantities of new materials, plus the existing inventory in the facility, is compared with the threshold values in the applicable table in the appendices.

Figure 7 provides entry to the tables. Please note, however, that these tables should not, by themselves, be used to establish the safety basis for a facility. Combinations of materials, the effects of various operations, and many other factors go into establishing a facility's SBE. See Document 3.1, "Safety Analysis Program," in the *ES&H Manual* for more details. FMs and FPOCs should consult their ES&H Team for additional guidance when the quantities of material proposed for a project approach the thresholds listed in this document.

Maintaining the inventory of chemical, explosive, and radiological materials within the SBE is an important part of the interface between the WAL and the FAL. Two primary processes are used to maintain inventories within allowable limits. The first involves the ongoing discussions between the FPOC and the Responsible Individuals (RI) and Authorizing Individuals (AI) regarding the current inventory within the facility and the applicable limits. While this discussion starts in the planning stage, its first critical point is at the time that the RI presents an Integration

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<sup>2</sup> *Environment, Safety and Health (ES&H) Manual* (URL MA133867).

Work Sheet (IWS) to the FPOC for a new or revised activity. The FPOC confirms that the authorizing management chain understands the various facility controls, including those associated with the inventory limits. The FPOC checks to confirm that the addition of new materials does not exceed the SBE limits for the facility, without the expressed desire of the facility management to increase the hazard ranking of the facility. The second process involves periodically assessing the status of the facility inventory of hazardous and radioactive materials. The periodicity of this assessment depends on several factors, including how close the facility is to the inventory limit, how dynamic the operations are within the facility, and past experience with issues associated with the facility inventory. The tables referenced in this document are provided as tools to facilitate this process.

To provide a buffer so that Work Smart Standards (WSS) threshold requirements are not exceeded, authorizing organizations and facility ADs may establish administrative thresholds lower than those described in the tables presented here. Such administrative levels shall be stated in Facility Safety Plans (FSP), Directorate ISMS Implementation Plans, or similar documents. In addition, Document 3.1 establishes a graded approach to increased scrutiny as threshold limits are approached.

It may be necessary to establish a method or procedure to track the quantities of specific materials that approach the thresholds, in the facility. The Laboratory's CHEMTRACK System is used to assist in this process.

## 2.0 Facility Safety Basis and Controls

### 2.1 Safety Basis Envelope/Facility Authorization Level

The facility ES&H system starts with an assessment of the hazards<sup>3</sup> associated with a given facility. This evaluation establishes the safety basis envelope for the facility and, through LLNL's graded approach, establishes the FAL<sup>4</sup>. As part of the analysis to establish the SBE, key safety elements<sup>5</sup> are identified and EIS/EIR and environmental permit limits are considered. Safety basis documents (Screening Report (SCR), Hazard Assessment Report (HAR), Safety Analysis Report (SAR), Safety Assessment Document (SAD), Accelerator Safety Envelope (ASE), Technical Safety Requirements (TSR), and / or Operational Safety Requirements (OSR)) are developed as appropriate

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<sup>3</sup> Document 3.1, "Safety Analysis Program," in the *ES&H Manual*.

<sup>4</sup> Document 2.2, "Managing ES&H for LLNL Work," in the *ES&H Manual*, Appendix 2C Table 2C-1.

<sup>5</sup> Herein, safety elements refers to safety related systems, structures, components and operations.

Figure 1 depicts the SBE for a facility where the analysis mechanism depends on the facility authorization involved. Likewise, required control documentation is FAL-driven. LLNL uses eight FALs:

- General Industry Facilities
- Low Hazard Facilities
- Radiological Facilities
- Accelerator Facilities
- Moderate Hazard Facilities
- Explosive Facilities
- Category 3 Nuclear Facilities
- Category 2 Nuclear Facilities

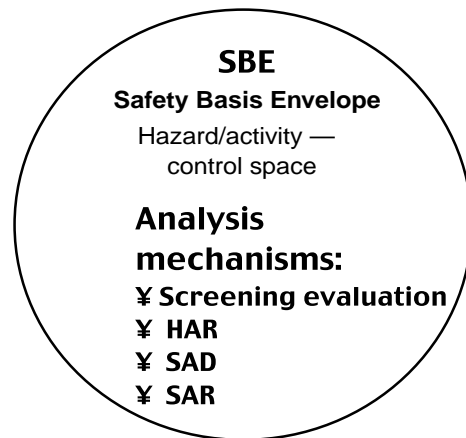


Figure 1

The controlling documentation requirements for each FAL (level) are specified in the LLNL *ES&H Manual*. They include:

- Controls specified in the *ES&H Manual* sections.
- Facility Safety Plans (FSPs).
- Combinations of SADs, SARs, ASEs, OSRs, and TSRs.

## 2.2 Facility Safety Plan

In the LLNL FAL system, an FSP is the primary mechanism for specifying the key controls necessary to meet the SBE requirements for all FALs above the General Industry level<sup>6</sup>. For General Industry facilities, the primary mechanism for specifying key controls to meet SBE requirements is the SCR, the IWS, and the *ES&H Manual*.

For practical purposes, not every common public or industrial hazard or safety element is listed in the SBE. Instead, general statements may be used to address these hazards and safety elements. Likewise, as shown in Figure 2, not every hazard or safety element listed in the SBE is addressed with a control in the FSP. For example, some FSP controls may only address the hazards for activities planned or expected for the facility at the time the FSP was developed.

<sup>6</sup> Document 3.1, 2.10 Implementing The Required Controls Documented in the Safety Analysis, November 19, 1999, Version.

The SBE space not explicitly included in the FSP may contain one or more of three types of hazards and/or safety elements:

- **Administrative Operating Margins**—The FSP limits are lower than those stated in the SBE to provide an operating safety margin (i.e., work to quantity X, where the SBE limit is  $Y > X$ ) (where Y is the limit defined by the SBE.).
- **General ES&H Statements**—General statements included in the SBE about common hazards and controls (e.g., OSHA and environmental).
- **ES&H Manual Controls**—Hazards for which the *ES&H Manual* provides controls (to stay within an SBE) that are adequate without specific documentation (e.g., various other common hazards).

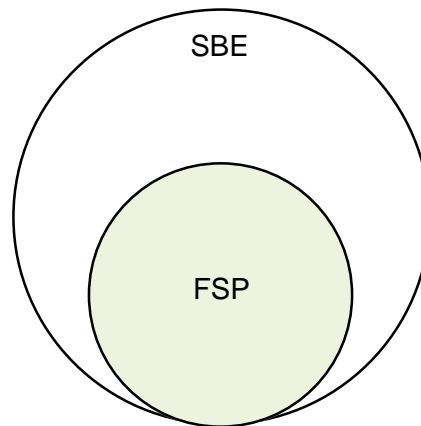


Figure 2

### 3.0 The FAL/WAL Interfaces

#### 3.1 Work Activity Level

Work activity documents<sup>7</sup> are developed where more specificity is required to ensure that work is performed safely. Typical work activity documents include:

- Integration Work Sheets (IWSs)
- Operational Safety Plans (OSPs)
- Standard Operation Procedures (SOPs)<sup>8</sup>
- Work Permits
- Maintenance Operating Procedures (MOPs)

Use of these work-activity documents is specified in the *ES&H Manual*, or may be used as a good-management practice by the responsible or authorizing individual. *In all cases, the hazards and controls specified in a WAL document must be within the envelope specified by the SBE document(s) for the facility in which the work is to be done.*

<sup>7</sup> Document 2.2,, Appendix2A Table 2A-2.

<sup>8</sup> Document 3.4, "Preparation of Work Procedures," in the *ES&H Manual*.

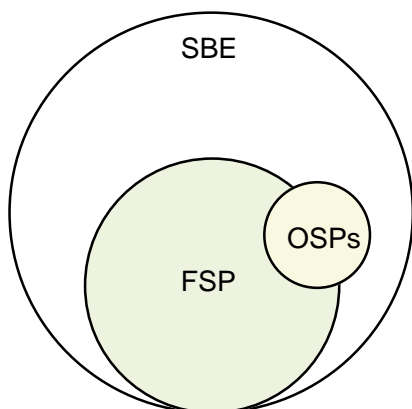


Figure 3

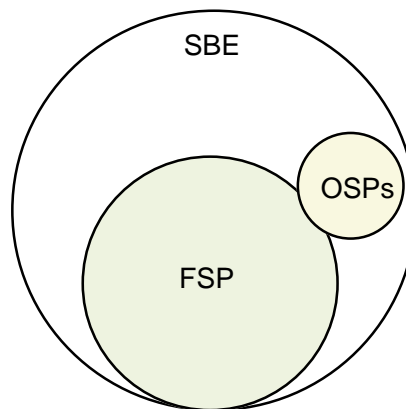


Figure 4

FSPs, OSPs, or IWSs (Section 3.2) are required for most hazardous-work activities. As shown in the following diagrams, OSPs may be used in two ways: a) where more specificity is required (Figure 3), and b) where an FSP exists and new, short-term work is being planned (Figure 4). Note that in both cases the FSP and OSP activities are within the SBE. *The responsible individual, authorizing individual, and reviewers must ensure that the OSP is consistent with all controlling requirements (e.g., FSP, SAR, TSRs, OSRs) included in the SBE documents.*

After review to ensure that they lie within the SBE, new activities that fall outside the existing FSP and any OSPs may be carried out using appropriate controls stated in a *modified* FSP, an OSP, or other relevant control document. For activities that fall outside the SBE (Figure 5), either proposed or discovered, a revised SBE that encompasses the new activity is required (See Document 3.1). Most likely, a revised FSP and/or other controlling document(s) also will be required, per the *ES&H Manual*.

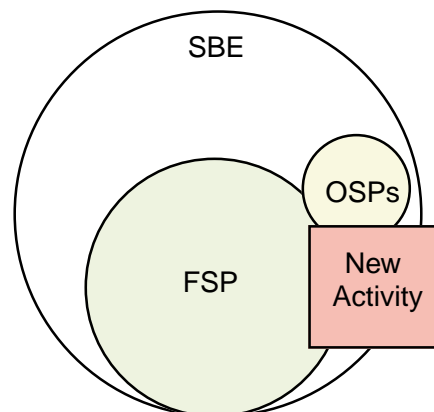


Figure 5

### 3.2 Integration Work Sheet

All new or changing activities at LLNL that are not commonly performed by the public require an IWS to be completed to determine if new hazards or safety-element impacts are introduced by the changes<sup>9</sup>. (The *ES&H Manual* definition of "commonly performed by the public" is "An activity with hazards commonly accepted by the public, the control of which requires little or no guidance or training to perform the work safely.")

<sup>9</sup> Document 2.2, Section 2.1 Table 1 and Section 2.7.2



Figure 6 illustrates the range of possibilities that could be raised in the IWS process and that must be addressed by the responsible individual, authorizing individual, and reviewers. Those activities within the controls of the existing FSP or OSPs and/or the *ES&H Manual* (IWS activities "A") may be authorized. IWS activities "B" (those within the SBE, but outside either the FSP or applicable OSPs) may be authorized *provided* any additional controls necessary to ensure the work remains within the SBE or meet WSS requirements are applied. This is usually documented by means of a change to the FSP, an OSP, etc.

Finally, for IWS activities "C" (those outside the SBE), a new safety analysis, documented in a revised SBE is required. (A new Work Smart Standard also may be needed.) In all three cases, the new hazards, controls, or safety-element changes must be analyzed and approved and undergo a pre-start review before work can begin.

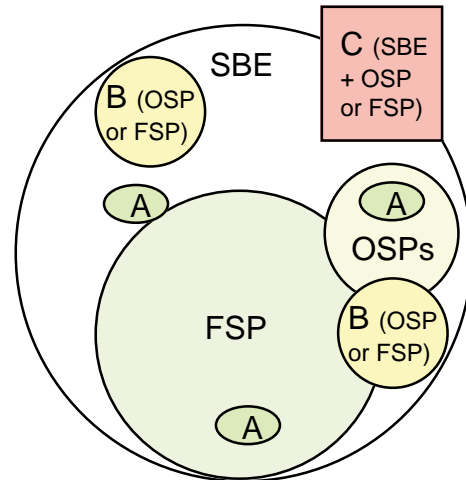


Figure 6

## 4.0 Related Information

### 4.1 Configuration Management Program

The Laboratory's Configuration Management Program (CMP) manages the configuration of systems, structures, components and documentation that are important to safety. The CMP describes the following CMP criteria:

- Identify the hazards and safety elements to be controlled.
- Control the changes to the identified elements and to the documents describing them.
- Document the changes and notify affected individuals.
- Verify the status of the elements through self-assessments and/or audits.

The SBE process identifies the critical hazards, controls, and safety elements for CM. For General Industry facilities, these may only be life safety systems (e.g., emergency evacuation paging systems, fire sprinkler systems, or fire alarms). For higher FALs, there likely will be more items to consider in the CM process. Refer to Document 3.1 for the details of the SBE change control process.

## 4.2 Facility and Work Authorization

Facility and work authorization requirements are indicated in the *ES&H Manual*<sup>10</sup> for each FAL and WAL. For nuclear facilities, the USQ process is used to determine who approves a change to be made within the facility. However, it is facility management that actually verifies that the change does not violate the SBE by signing the IWS.

## 4.3 Safety Basis Thresholds Table

Initial screening of buildings to determine their "hazard classification" is based on comparison of the quantities of specified materials in a building or part of a building to the tables referenced below. In the case of hazardous chemical, the screening is performed against the quantity of each individual chemical type. For radioactive materials, the screening is based on comparison of the cumulative fraction of each material compared to its criteria value. For explosives, initial screening of a facility with any explosives will determine if it is an explosives facility. Finally, for accelerator facilities, if the accelerator is capable of producing particles with an energy level of 10 MeV or above and capable of producing a radiological area potentially exposing the whole body of a receptor, it is initially classified as an accelerator facility. Further documentation, looking at the effect of unusual hazards, chemicals not on the lists provided or the results of more in depth analysis may cause the initial hazard classification of the facility to be altered. The applicable tables for initial differentiation between the different categories are attached.

After initial screening establishes the hazard rank (FAL) of the facility and its safety basis envelope, the FM, FPOC, or other interested people may use the tables as a tool to maintain the SBE or to ensure that the SBE is not violated. Starting with Figure 7, look in the box for the applicable facility, and identify the appropriate table to evaluate a particular chemical or radioactive material. (The tables may be hot linked from Figure 7.) Find the material in the table, and see if the proposed new quantity, in addition to the existing quantity in the facility, exceeds the stated limit. Note that the SAR or HAR for some facilities may set the SBE to quantities lower than those listed in the tables. The SBE can be maintained by reducing inventory, withholding concurrence for a new or revised activity, or obtaining a management decision to have the facility classified at a higher level. See Document 3.1 for change control and configuration management of the SBE.

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<sup>10</sup> Document 2.2, Appendix 2C, Table 2C-1 and Appendix 2A, Table 2A-2 respectively.

CHEMICAL CLASSIFICATIONS	RADIOACTIVE MATERIALS CLASSIFICATIONS	EXPLOSIVE CLASSIFICATION	ACCELERATOR CLASSIFICATION
	<u>Nuclear 1 Category</u> DOE assigned, not generally used		
<u>High Hazard Category</u> • Not Used	<u>Nuclear 2 Category</u> • Below cumulative radionuclide ratios in columns 2&3 in DOE S 1027, Attachment 1, table A.1  • SAR, FSP, OSPs required • DOE approves SAR		
<u>Moderate Hazard Category</u> Above: • Threshold Quantity (TQ) in 29 CFR 1910.119, Appendix A • Threshold Planning Quantity (final column,) in 40 CFR 355, Appendix A  • SAR, FSP, OSPs, IWSs required • DOE approves SAR	<u>Nuclear 3 Category</u> • Below cumulative radionuclide quantity ratios for Nuclear Category 2, but above cumulative quantity ratio in Columns 4&5 in DOE S 1027, Attachment 1, table A.1  • SAR, FSP, OSPs, IWSs required • DOE Approves SAR	<u>Explosives Facility</u> • Classified as an explosive handling facility if any amount of explosive is used unless a HAR determines that only the handler is at risk  • SAR or HAR, FSP and OSP, IWS required • DOE approves SAR • Process Safety Management applies (29 CFR 1910.119) in some cases	<u>Accelerator Facility</u> • Classified as accelerator facility if more than 10 MeV is produced and, • Capable of producing a radiological area potentially exposing the whole body of a receptor  • SAD, FSP, OSP, IWS Required • DOE Approves SAD and conducts a readiness review before accelerator startup
<u>Low Hazard Category</u> Below criteria for Moderate Hazard, but above criteria in: • 40 CFR 355, Appendix A (Middle Column, Reportable Quantities) • 40 CFR 302.4, Appendix A Final reportable quantities (RQ) in last column  • HAR, FSP, OSP, IWS • LLNL Approved	<u>Radiological Category</u> Below criteria for Nuclear category 3 facility, but above reportable quantities in : • 40 CFR 302.4 Appendix B. Final Reportable Quantities (RQ), last column  • HAR, FSP, OSP, IWS • LLNL Approved		
<u>General Industry Classification:</u> Below Reportable Quantities (Chemicals) in 40 CFR 355, Appendix A,(middle column) Below Final Reportable Quantities [RQ](Chemicals) in 40 CFR 302.4, last column Below the Radiological Threshold (Radioactive Chemicals) Listed in 40 CFR 302.4, Appendix B (Final RQ) No unusual chemicals not on lists above No non-routine hazards Safety Analysis Documentation: Facility Screening Report (LLNL Approval Only) Other Documentation Which May Be Needed: IWSs, OSPs			

Figure 7. Facility Hazard Classifications.

**Terms:**

SAD—Safety Analysis Document

SAR—Safety Analysis Report

HAR-Hazards Analysis Report

SCR—Facility Screening Report

FSP—Facility Safety Plan

OSP—Operational Safety Plan

IWS—Integration Work Sheet

## **5.0 Responsibilities**

### **5.1 Facility Managers**

- Responsible for maintaining the SBE for their facilities.

### **5.2 Facility Point of Contact**

- Responsible for checking new processes or materials being introduced into the facility, to ensure that the SBE is not violated.
- Responsible for checking additional quantities of existing materials being introduced into the facility, to ensure that the SBE is not violated.

## **6.0 Work Standards**

29 CFR 1910.119, Appendix A, OSHA List of Highly Hazardous Chemicals, Toxics and Reactivities.

40 CFR 302.4, Appendix A, EPA Final Reportable Quantities (RQ) for Chemical Agents, Criteria for Low-Hazard Facilities.

40 CFR 302.4, Appendix A, List of Hazardous Substances and Reportable Quantities.

40 CFR 302.4, Appendix B, EPA Final Reportable Quantities (RQ) for Radionuclides.

40 CFR Part 355, Appendix A, EPA List of Reportable and Threshold Planning Quantities.

DOE Standard 1027, Attachment 1, Table A.1, Category 2 and 3 Radionuclide Limits.

## **7.0 Resources for More Information**

### **7.1 Contacts**

ES&H Team.

### **7.2 Applicable Lessons Learned**

Refer to the list of Lessons Learned at the following website:

[http://www-r.llnl.gov/es\\_and\\_h/lessons/lessons.shtml](http://www-r.llnl.gov/es_and_h/lessons/lessons.shtml)